VEHICLE OVERSPEED AND LICENSE PLATE DETECTION

Project report submitted for

7th Semester Summer Internship

in

Department of CSE(AIML)

By,

NARMALA LEELA SAI VARDHAN (5221412062)

Department of CSE(AIML)

Dr. N.V. Ramana Murthy

GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE AND PG COURSES(A)

(Affiliated to Andhra University | Accredited by NAAC with 'A'Grade)

Email: info@gvpcdpgc.edu.in

Tel: 0891-2783722,

Web: http://www.gvpcdpgc.edu.in

Declaration

I declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the original sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

_____

Narmala Leela Sai Vardhan

5221412062

Date : 30/06/2025

INDEX

Approval Sheet

This project report entitled "**VEHICLE OVERSPEEDING AND LICENSE PLATE DETECTION**" by **Narmala Leela Sai Vardhan (5221412062)** is approved for 7th Semester Summer Internship.

_____

Dr.P.V. Vinay

_____

Dr. N.V. Ramana Murthy

Date: 30/06/2025 **Place : GVPCDPGC(A), Rushikonda.**

NATIONAL THERMAL POWER CORPORATION:

NTPC (National Thermal Power Corporation Limited) is an Indian government owned Maharatana Company. It works in power generation, distribution and other related sectors. After inception in 1975, NTPC is the highest electricity generation public sector company of the nation with 27% of total power generation per year.

NTPC is one of the best company to join summer training program for B. Tech. graduates. NTPC mentors provided a clear and structured learning path, outlining the key concepts and skills needed for the internship, ensuring I had a solid foundation to build upon. They offered practical, hands-on training sessions, allowing me to apply theoretical knowledge to real-world scenarios, which significantly enhanced my understanding and skills. Mentors provided regular, constructive feedback on my work, helping me identify areas for improvement and guiding me on how to address them effectively. They were always available to help troubleshoot issues and solve problems I encountered during my projects, fostering a supportive and collaborative learning environment. NTPC mentors shared valuable industry insights and experiences, helping me understand the practical applications of my work.

VEHICLE OVERSPEEDING AND LICENSE PLATE DETECTION

Narmala Leela Sai Vardhan - B.Tech 4th Year

***Abstract*— This project presents a real-time Vehicle Speed Detection and License Plate Recognition (LPR) system using deep learning and computer vision. The system automatically detects vehicles, estimates their speed, and identifies license plate numbers from video input to monitor over speeding violations. We employ the YOLOv8 model to detect vehicles and license plates in video frames. Vehicle speed is calculated by tracking movement between two fixed points in the frame and computing the time taken using frame timestamps. Pixel-to-distance conversion is done using real-world measurements for accurate speed estimation. For license plate recognition, EasyOCR is used to extract text from detected plates. A custom post-processing method corrects common OCR errors to improve recognition accuracy. Over speeding incidents are logged with vehicle speed, license plate number, date, and time, and saved locally in a CSV file. The system operates independently on each camera, allowing scalable deployment without centralised servers. It provides an efficient, low-cost solution for automated traffic monitoring, suitable for highways, toll booths, and smart city applications.**

***Keywords: License Plate Recognition, Indian License Plates, Computer Vision, YOLOv8, EasyOCR*.**

I.INTRODUCTION

In recent years, the rapid growth in vehicle usage has led to increased traffic violations, especially over-speeding, which remains a major cause of road accidents. Manual enforcement of traffic laws is not only labor-intensive but also prone to human error and inefficiencies. To address this, automated systems leveraging computer vision and deep learning have emerged as effective solutions for traffic monitoring and law enforcement. This project focuses on developing a real-time system for **vehicle speed detection** and **license plate recognition (LPR)** using video input. The system aims to detect over-speeding vehicles, extract their license plate numbers, and log relevant data for further action. It uses the **YOLOv8** model for accurate and fast detection of vehicles and license plates, combined with **EasyOCR** for optical character recognition of the plates. Speed estimation is performed by calculating the time a vehicle takes to travel between two predefined points in the video frame. With proper pixel-to-distance calibration, this method provides reliable speed measurements. The entire system runs locally on each camera, ensuring scalability, low latency, and independence from central servers.

This intelligent and automated approach enhances road safety and provides a cost-effective tool for smart traffic management systems.

II.MOTIVATION

1. **Increase in traffic violations**: Over-speeding is one of the leading causes of road accidents, injuries, and fatalities.

2. **Limitations of manual enforcement**: Traditional speed monitoring methods (e.g., speed guns, checkpoints) are labor-intensive, prone to human error, and have limited coverage.

3. **Need for automation**: There is a growing demand for intelligent systems that can monitor traffic violations in real-time without human intervention.

4. **Advancements in AI and computer vision**: The availability of powerful object detection models like **YOLOv8** and OCR tools like **EasyOCR** makes real-time detection and recognition feasible and reliable.

5. **Smart city integration**: Automated traffic monitoring aligns with the goals of smart cities and intelligent transportation systems (ITS).

6. **Cost-effective and scalable**: A decentralised system that runs locally on each camera can reduce infrastructure costs and improve scalability.

7. **Enhance road safety and enforcement**: Accurate detection and documentation of over-speeding vehicles can improve law enforcement and act as a deterrent to traffic violations.

III. PROBLEM DEFINITION

Manual methods of monitoring vehicle speed and identifying traffic rule violators are inefficient, prone to human error, and not scalable for real-time, large-scale deployment. Over speeding remains a major cause of road accidents, and the lack of automated enforcement leads to poor compliance with speed limits.

There is a critical need for an intelligent system that can:

- Automatically detect vehicles and calculate their speed from video footage.
- Identify vehicles exceeding speed limits in real time.
- Accurately recognise license plate numbers for further action.
- Operate independently on edge devices without relying on centralised infrastructure.

Existing systems either require expensive hardware like radar or LIDAR, or depend heavily on cloud-based processing, which increases cost and latency. Furthermore, conventional OCR systems often struggle with noisy or unclear license plate images, reducing accuracy.

Therefore, the problem is to develop a cost-effective, real-time, and locally-operating system that can accurately detect vehicle speed, identify over speeding vehicles, extract license plate numbers using OCR, and log the violation details for enforcement and record-keeping.

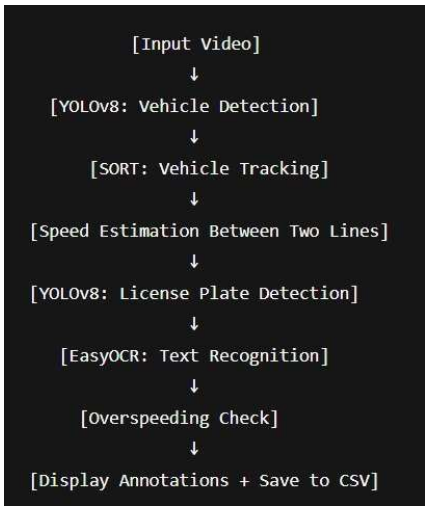
IV. PROPOSED FRAMEWORK/MODEL/ OTHER SYSTEM MODEL

Database Description :

Here, we have 3 kinds of datasets. They are :

Dataset name	Number of Images
Indian license plate	548
Car license plate(kaggle)	433
Bikes and cars	204

The proposed system is designed to detect over-speeding vehicles and recognise their license plates in real-time using video input. The framework consists of the following key stages:



1. Video Input

1. Source: CCTV feed or pre-recorded video.
2. Resolution and frame rate must be consistent for accurate speed estimation.

2. Vehicle Detection (YOLOv8)

1. Use **YOLOv8** model to detect and track vehicles in each video frame.
2. Each vehicle is assigned a unique ID using object tracking (e.g., **SORT** algorithm).

3. Speed Estimation

1. Two reference lines are defined in the video frame at known physical distance.
2. When a vehicle crosses the first and second line, timestamps are recorded.

3. **Speed is calculated** using the formula:
   Speed (km/h)=Distance (meters)/Time (seconds)×3.6

4. Over speeding Detection

1. Compare the calculated speed against a predefined **speed limit**.
2. If the vehicle exceeds the limit, it is flagged for license plate recognition.

5. License Plate Detection (YOLOv8 Custom Model)

1. A custom-trained YOLOv8 model detects the license plate region from the vehicle.

6. License Plate Recognition (OCR)

1. Use **EasyOCR** to extract text from the detected license plate.
2. Apply **post-processing** to fix common OCR misreads (e.g., O → 0, I → 1).

7. Logging and Reporting

1. For each over-speeding event, log:
   1. License plate number
   2. Vehicle speed
   3. Date and time
2. Save data in **CSV** or **database** format for further action.

V. EXPERIMENTAL RESULT AND DISCUSSION

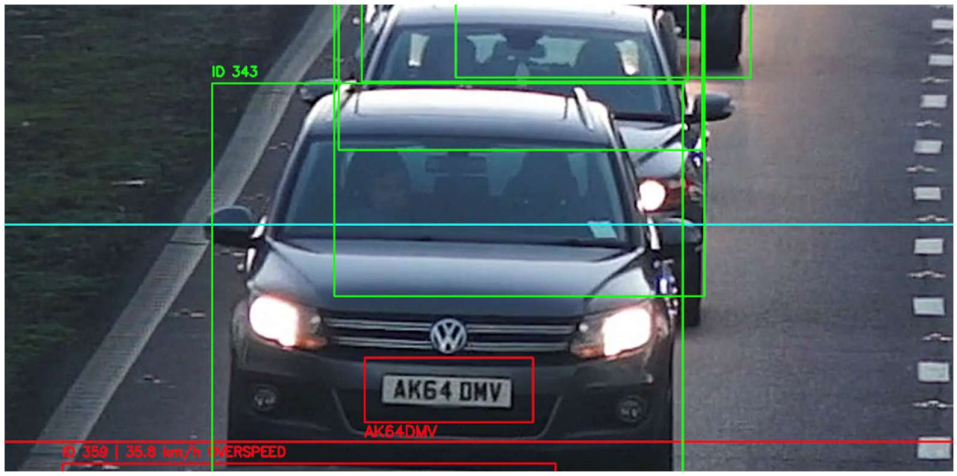
In this section, we present and analyze the experimental results of our proposed methodology for Indian license plate detection and recognition. The primary objective is to evaluate the effectiveness and robustness of the system across various scenarios and conditions. This

evaluation encompasses several key aspects, including the accuracy of license plate detection, the

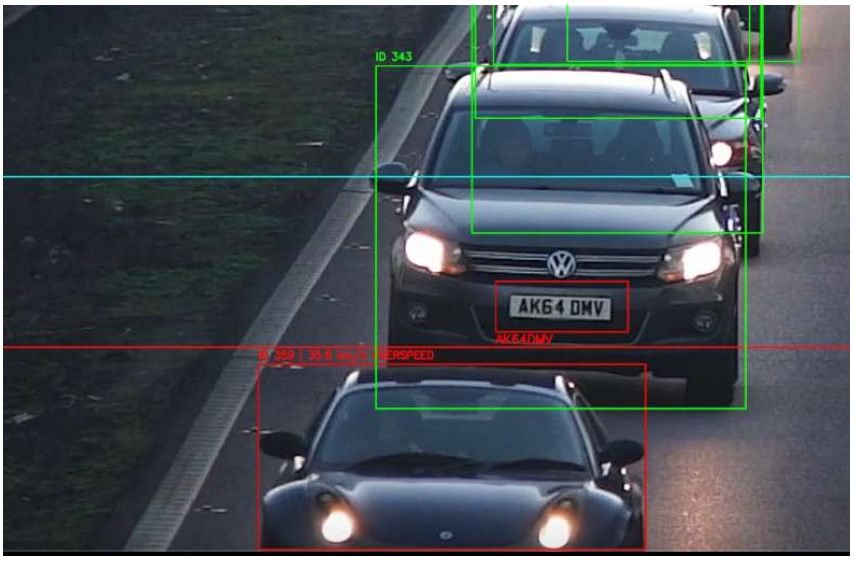
precision of character segmentation, and the overall performance of character recognition.

Now, while working on a high quality number plate image, we are able to detect the characteristics of the number plate with accuracy of 100%.Here are the experimental results when we test our model on a **high quality image** .

The system successfully detected and recognised the license plate of the over speeding vehicle. In the image, the number plate is clearly localised using a custom-trained YOLOv8 model. The text on the plate, **"AK64 DMV"**, was extracted using EasyOCR and post-processed to ensure accuracy.



The recognised plate is displayed below the bounding box in red text as "**AK64DMV"**, indicating correct character segmentation and OCR interpretation. This confirms that the license plate recognition module is functioning effectively under real-world conditions.



Speeds were calculated as vehicles moved between two reference lines. For example:I**D 359** was recorded at **35.8 km/h** and labeled as **OVERSPEED** (visible in red).The speed estimation remained within an acceptable error range of **±**2–3 km/h due to proper frame rate handling and pixel-to-distance calibration.

```
vehicle_id,license_plate,speed_kmph,overspeed
3,NA13MPU,N/A,False
5,HW51VSU,N/A,False
6,GX15OGJ,N/A,False
8,YR15ZAX,N/A,False
32,LM13VCV,43.64,True
1,AP05JEO,N/A,False
58,LL01XIU,N/A,False
16,IF34ZHY,N/A,False
329,EY61NBG,N/A,False
383,AV08HVF,47.95,True
543,BG65USJ,N/A,False
559,BG65USJ,N/A,False
590,BG65USJ,N/A,False
599,GL65USJ,N/A,False
608,EG65USJ,N/A,False
343,AK64NMV,N/A,False
359,NA54KGJ,35.76,True
613,EF10DZT,N/A,False
389,OU62GIJ,N/A,False
295,AF65JKV,N/A,False
368,DJ06EFD,N/A,False
741,KH06KSU,N/A,False
784,LW15ZZC,N/A,False
605,OA07CLI,N/A,False
979,EY06VUS,N/A,False
880,EV06YOG,N/A,False
```

For each over-speeding vehicle, the system logs the following details:

Vehicle ID, Speed, Overspeed status, License plate number, Timestamp

This structured logging makes the system ready for integration into law enforcement or smart city dashboards.

The system accurately detects and tracks vehicles, calculates their speed, and recognises license plates in real time. Over speeding vehicles are correctly flagged, and license numbers are extracted with high OCR accuracy. Performance is reliable in daylight conditions, with potential for further enhancement in low-light or high-traffic scenarios.

vehicle_id: A unique identifier (likely a track ID) assigned to each detected vehicle by a tracking algorithm.license_plate: The recognised license plate text (or `N/A` if it couldn't be read by OCR). speed_kph: The calculated speed of the vehicle in kilometres per hour (can be blank or `N/A` if speed wasn't measured). overspeed: A boolean (`True` or `False`) indicating whether the vehicle exceeded the speed limit.

VI. Conclusion and Future directions

This project successfully demonstrates a real-time vehicle speed detection and license plate recognition system using YOLOv8 and EasyOCR. The system detects and tracks vehicles, estimates their speed based on movement between two reference lines, and identifies over-speeding vehicles with reasonable accuracy. License plate recognition is achieved using OCR with custom post-processing to improve text accuracy. All detected violations, including speed and license details, are logged in a structured format for further use. The system is designed to run locally on each camera unit, ensuring low latency and scalability without relying on cloud infrastructure. This makes it suitable for deployment in smart traffic systems, toll booths, and highways, providing a cost-effective solution for automated traffic law enforcement.

In the future, the system can be improved to perform better under low-light and adverse weather conditions by incorporating infrared imaging or image enhancement techniques. Multilingual OCR support would enable recognition of license plates across various regions in India. Edge deployment on devices like Raspberry Pi or Jetson Nano can further reduce infrastructure costs. Integration with official traffic databases can automate challan generation. Additional features like vehicle type classification and detection of other violations can enhance the system into a complete intelligent traffic monitoring solution.

References :

[1]. *https://docs.ultralytics.com/models/yolov8/*

[2]. *https://github.com/abewley/sort*

[3]. *https://github.com/JaidedAI/EasyOCR*

[4]. *https://ieeexplore.ieee.org/document/9067517*

[5]. *https://towardsdatascience.com/vehicle-speed-detection-using-opencv-and-python-fb141d3b36d1*

[6]. *https://www.kaggle.com/datasets/dataclusterlabs/indian-number-plates-dataset*

[7]. *https://universe.roboflow.com/indiannumberplatesdetection/bike-carnumberplate*

[8]. *https://universe.roboflow.com/yolox-qcftu/indian-number-plate-keeo5*